



Evaluation Report CCMC 14052-R Icynene ProSeal Air Barrier System

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1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that “Icynene ProSeal Air Barrier System,” when used as an air barrier system in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code (NBC) of Canada 2015:

- Clause 1.2.1.1.(1)(a), Division A, as an acceptable solution from Division B:
 - Article 5.1.4.1., Structural and Environmental Loads
 - Article 5.1.4.2., Resistance to Deterioration
 - Subsection 5.2.2., Structural Loads and Design Procedures
 - Subsection 5.4.1., Air Barrier Systems
 - Article 9.25.3.1., Required Barrier to Air Leakage (exterior walls only)
 - Sentence 9.25.3.2.(1), Air Barrier System Properties (effective barrier to air infiltration and exfiltration)
 - Article 9.25.3.3., Continuity of the Air Barrier System (exterior walls only)
 - Clause 9.27.4.2.(2)(b), Materials (ASTM C920, Elastomeric Joint Sealants)
- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
 - Sentence 9.25.3.2.(2), Air Barrier System Properties (alternative to 6 mil polyethylene air barrier)

This opinion is based on the CCMC evaluation of the technical evidence in Section 4 provided by the Report Holder.

Ruling No. 17-09-346 (14052-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2017-09-19 pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

2. Description

This Report addresses the performance of the product as an air barrier system for exterior walls as specified by Icynene Inc. The proprietary air barrier system is intended for application over infill walls, exterior gypsum over steel studs within concrete construction. The ProSeal system components and accessories as well as their functions (see Figure 1) are as follows:

- **Principal plane of airtightness:** Provided by “Icynene ProSeal™ (MD-C-200v3) spray polyurethane foam insulation compliant with ULC S705.1 (see CCMC 13683-L).
- **Continuity:** Accessories for continuity include two approaches – transition membrane and sealant:
 - Transition membrane (self-adhered with primer)
 - Blueskin SA, made by Henry Company, for use as a transition membrane between adjacent constructions, control and expansion joints, and at junctions between dissimilar materials; thickness is 1 mm (40 mil)¹
 - Primer
 - Blueskin Adhesive, made by Henry Company
 - Sealant (for small penetrations)
 - Sealant HE 925 BC – BES, made by Henry Company

1. The original full-scale testing was carried out with one proprietary transition membrane. Other proprietary membranes may be qualified for use by Icynene on a case-by-case basis through small-scale tension tests; for example, ProSeal sprayed specimens over the prescribed substrate to ensure the equivalent adhesion is maintained.
2.
 - **Component for strength to resist wind loads:** The product has been designated and evaluated for a steel stud infill wall assembly installed between concrete floors designed to withstand the anticipated wind loads as per the Icynene ProSeal Air Barrier System Manual. The scope of this Report is for the following infill wall design, specifically:
 - Steel studs (3-5/8 in. min., 18 ga min. or greater) installed at 400 mm (16 in.) on centre (o.c.) sheathed with 12.7 mm DensGlass® (DG) Sheathing, made by Georgia-Pacific Building Products LLC, with 31.75 mm (1¼ in.) SF corrosion resistant screws at 200 mm (8 in.) o.c.
 - **Insulation component:** The exterior insulation is provided by a minimum 38 mm thickness of Icynene ProSeal™ (MD-C-200v3) spray polyurethane foam (CCMC 13683-L) that has a long-term thermal resistance (LTTR) of RSI 2.02 for 50 mm.
 - **Installation:** The product is to be installed in accordance with the Icynene ProSeal Installation Manual, November 30, 2016. The ProSeal system is installed by Morrison Hershfield (MH) certified installers in accordance with the MH Quality Assurance Program. The installers must be trained and certified by MH according to the MH air barrier system certification scheme in order to spray the product on-site as per ULC S705.2. MH qualifies the installers to manufacture the spray foam and then assemble the components on-site to form the proprietary product. MH is an accredited third-party agency that provides installer certification in accordance with ISO 17024. MH also provides a third-party field audit of the installations on behalf of Icynene Inc. for their proprietary air barrier system.

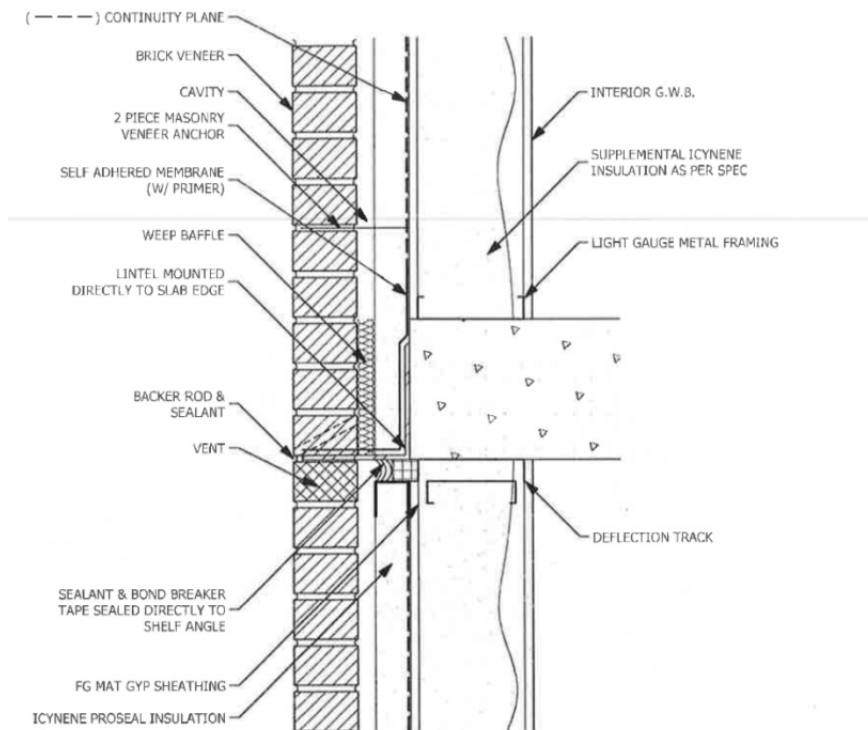


Figure 1. Example of a ProSeal Installation Manual detail that outlines the components and accessories needed to maintain continuity across the floor plate and to provide for movement of the concrete floor slab

3. Conditions and Limitations

The CCMC compliance opinion in Section 1 is bound by the “Icynene ProSeal Air Barrier System” being used in accordance with the conditions and limitations set out below:

- The product, with a minimum 38 mm thickness (1.5 in.) of ProSeal™ spray urethane (CCMC 13683-L) and a 38.2 kg/m³ density, has demonstrated sufficiently low air permeance with an air leakage rating of A1 (less than 0.05 L/s·m²·Pa at 75 Pa reference P) when tested in accordance with ULC S742. This air leakage conforms to the permissible air leakage rate in Table 4.1.1 with a low water vapour permeance (WVP) material as the outermost layer of the exterior wall assembly.
- In the above-mentioned specified infill panel construction with a 38-mm-thick ProSeal spray urethane, the product has demonstrated sufficient strength to resist wind loads so it can be used in low-rise buildings in geographical locations where:

- the wind pressure $Q_{50} \leq 550$ Pa (1-in-50 year wind pressure return period found in Appendix C of the NBC 2015), for a maximum building height of 12 m (i.e., 4-5 storeys);
 - the ULC S742 reporting classification is Class A1 (S550H12) for the assembly having been tested to $Q_{50} \leq 550$ Pa for a 12 m high building and obtaining an air leakage rate less than $0.05 \text{ L/s}\cdot\text{m}^2\cdot\text{Pa}$ (see Table 4.1.1); and
 - the maximum deflection recorded was 20 mm for the wall assembly for a gust wind load of 1 440 Pa.
- To provide the air leakage control and strength in the field, the product must be installed conforming to the limits above and installed in the field by MH certified installers/contractors according to the “Icynene ProSeal Air Barrier System Installation Manual,” November 30, 2016, which contains detailed construction drawings that must be followed. MH must conduct the necessary follow-up inspections to ensure that MH certified contractors are performing the necessary field quality control (for example, transition membrane application, membrane adhesion/pull testing before spraying, sealant application before spraying, spray foam as per ULC S705.2). All results must be recorded on the MH daily worksheet for the ProSeal air barrier system.
 - A copy of the installation instructions must be available on the job site at all times during the installation for review by building officials. All installers must present their MH identification card upon request by the building official.
 - The product must be identified with the manufacturer’s name or logo and the phrase “CCMC 14052-R.”

4. Technical Evidence

The Report Holder has submitted technical documentation for the CCMC evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

4.1 Performance Requirements

The product has demonstrated performance requirements that meet the criteria of the CCMC Technical Guide for air barrier systems. To qualify, a conforming air barrier system must:

- have an acceptable low air leakage rate;
- be continuous;
- be durable;
- have sufficient strength to resist the anticipated air pressure load; and
- be buildable in the field.

Table 4.1.1 Results of Testing the Air Leakage Rate of the Product After Wind Loading¹

Steel Stud Frame Walls	Results		Requirement ²
	Air Leakage Rate After Wind Loading ¹ at 75 Pa ΔP	Air Leakage Rate After Wind Loading at -20°C and at 75 Pa ΔP^2	
Specimen No. 1 – opaque wall	0.0059 L/(s·m ²)	0.0059 L/(s·m ²)	A1 (less than 0.05 L/s·m ² ·Pa)
Specimen No. 2 – continuity at penetrations, foundation, brick straps	0.0098 L/(s·m ²)	0.0105 L/(s·m ²)	
Specimen No. 3 – wall/foundation continuity	≤ 0.01 L/(s·m ²)	≤ 0.015 L/(s·m ²)	

Notes to Table 4.1.1:

1. The air leakage rate of the specimens is determined after structural aging of the air barrier system. Aging of the air barrier system was conducted to qualify it for a design structural wind load of $Q_{50} = 0.55$ kPa (NBC climatic data in Appendix C) for a 1-in-50 year return period. The air barrier system was subjected to a loading schedule involving one-hour sustained positive and negative pressure set at 0.55 kPa, 2 000 cycles of positive and negative pressure set at 0.80 kPa, and a wind gust of positive and negative pressure set at 1.2 kPa.
2. The air leakage rate was determined in accordance with ASTM E1424-91(2008), “Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure and Temperature Differences Across the Specimen,” at an air temperature of -20°C to verify any deformation causing leakage at low temperatures.
3. The air leakage performance results in a Classification A1 as per CAN/ULC-S742-11, “Standard for Air Barrier Assemblies – Specification.” The air leakage rate criteria is based on the permissible air leakage rates shown in Table 4.1.2, which are considered to be in accordance with the NBC in regard to the air barrier system performance and drying potential of the wall assembly.

Table 4.1.2 Permissible Air Leakage Rates of the Product

Drying Potential Based on WVP of Outermost Layer of Wall Assembly (ng/Pa·s·m ²)	Maximum Permissible Air Leakage Rates (L/s·m ²) @ 75 Pa
15 < WVP ¹ ≤ 60	0.05 ¹
60 < WVP ≤ 170	0.10
170 < WVP ≤ 800	0.15
> 800	0.20

Note to Table 4.1.2:

- As the ProSeal spray urethane has a WVP less than 60 ng/Pa·s·m² for a 38 mm thickness, this air leakage requirement must be met for Code compliance due to the risk of condensation based on this air leakage rate.

Table 4.1.3 Results of Testing the Durability of Product Components

Property	Requirement	Result
Icynene ProSeal™ (MD-C-200v3) spray urethane	Air permeance before and after aging (ASTM D726-84) < 10% increase	Pass ¹
	Thermal resistance after heat aging and weathering 90% retention	Pass ²
Blueskin SA – transition membrane	Physical properties testing ³	Pass ³
Sealant HE 925 – BES – caulking/sealant accessory	Meets ASTM C920 Type S, Grade NS, Class 35 ⁴	Pass
Membrane adhesion to DensGlass sheathing	ASTM D3330-04	Determined tension/peel strength values for field quality control

Notes to Table 4.1.3:

- The results of the testing were deemed a pass when reviewing the low air leakage performance and considering the error and bias of the test procedure.
- The thermal testing results after aging varied, but remained within the expectations of the published LTTR value.
- Blueskin SA has been tested to validate several physical properties, such as elongation, WVP, puncture resistance, watertightness and crack bridging, with a minor durability assessment. However, Blueskin WP 200 (CCMC 13297-R) has been evaluated by CCMC for durability and is the same membrane technology as Blueskin SA, which is thinner. As the membrane will be protected and insulated by the ProSeal spray urethane, the durability of Blueskin SA was deemed a pass for this application for low rise, 12 m high buildings.
- The sealant manufacturer has tested to ASTM C920, “Standard Specification for Elastomeric Joint Sealants,” as specified in Article 5.9.1.1., Compliance with Applicable Standards, and Sentence 9.27.4.2.(2), Materials, of Division B of the NBC 2015.

Table 4.1.4 Result of Testing the Wind Load Resistance of the Product

Property	Attachment Schedule	Wind Load Limit	Deflection of Infill Wall
Icynene ProSeal Air Barrier System on specified steel stud back-up wall	Self-drilling screws, grabber No. 210 scavenger head fastener or equivalent at 200 mm (8 in.) o.c.	1 440 Pa	Max. 20.1 mm

Report Holder

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Appendix A – Additional Information

Figures 1 to 4 show typical construction details to be reproduced in the field by MH trained installers as part of the installation quality control of the product. For specific details see the “Icynene ProSeal Air Barrier System Installation Manual,” November 30, 2016.

Figure 5 shows the system penetration details of one of the three test specimens used for the qualification testing. The opaque wall specimen with no penetration and the wall specimen with foundation wall continuity are not shown.

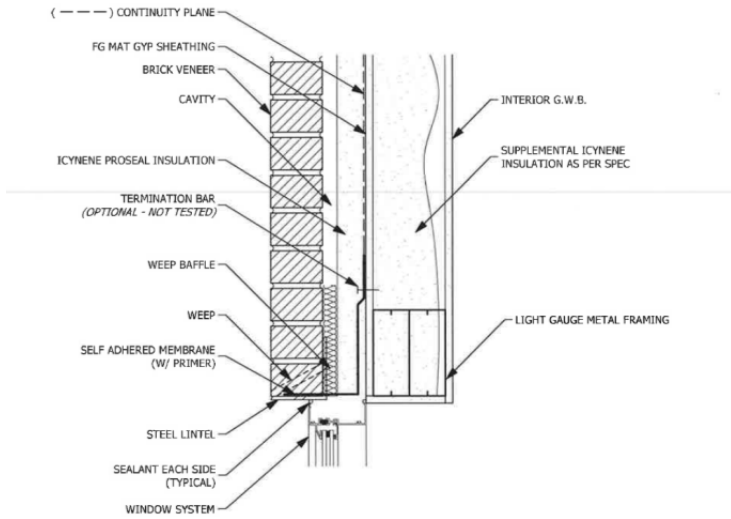


Figure 1. “Icynene ProSeal Air Barrier System” top of window sealing continuity

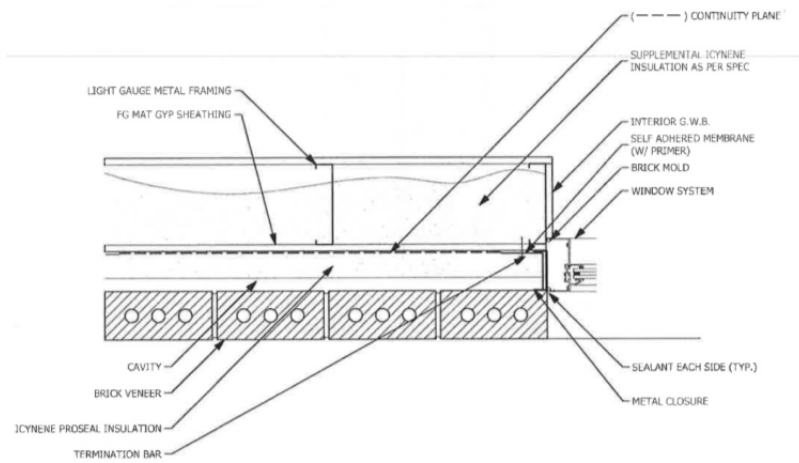


Figure 2. “Icynene ProSeal Air Barrier System” window side sealing continuity

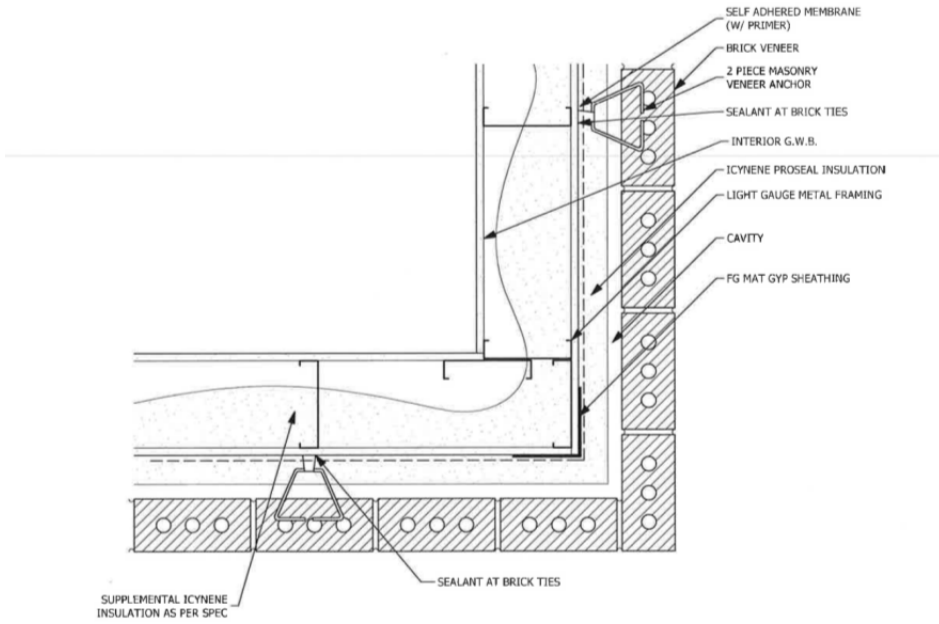


Figure 3. "Icynene ProSeal Air Barrier System" outside corner detail

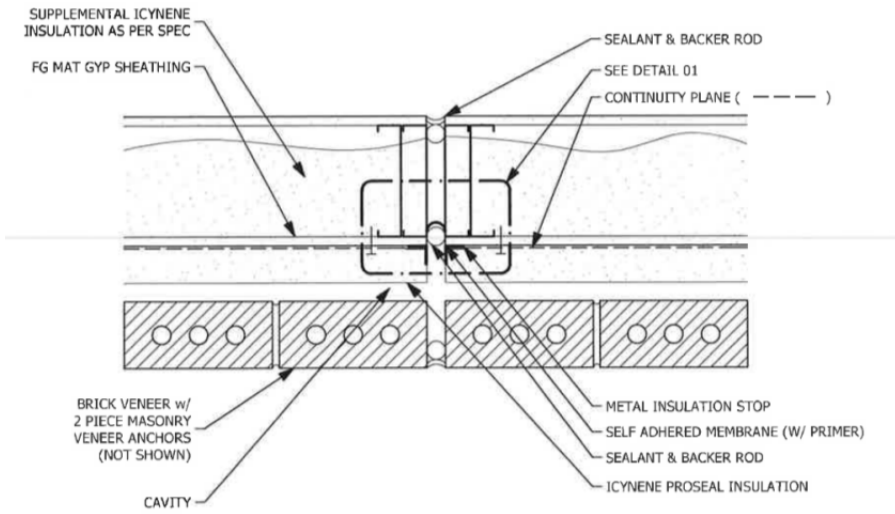


Figure 4. "Icynene ProSeal Air Barrier System" expansion joint sealing and continuity detail

1 ICYNENE PROSEAL INSULATION	8 GALVANIZED STEEL DUCT 4"x4" (TYP)
2 FG MAT GYP SHEATHING	9 PVC PIPE 1 1/2" DIA. (TYP)
3 STRUCTURE (STEEL)	10 ELECTRICAL BOX (TYP)
4 SELF ADHERED MEMBRANE (W/ PRIMER)	11 FG MAT GYP SHEATHING JOINT (TYP) (STAGGERED)
5 ROUGH WINDOW OPENING (TYP)	12 SEALANT
6 3 5/8" STEEL STUD (20 GA)	13 BACKER ROD (TYP)
7 CONCRETE FOOTING 8"x10" WITH REINFORCEMENT (TYP)	

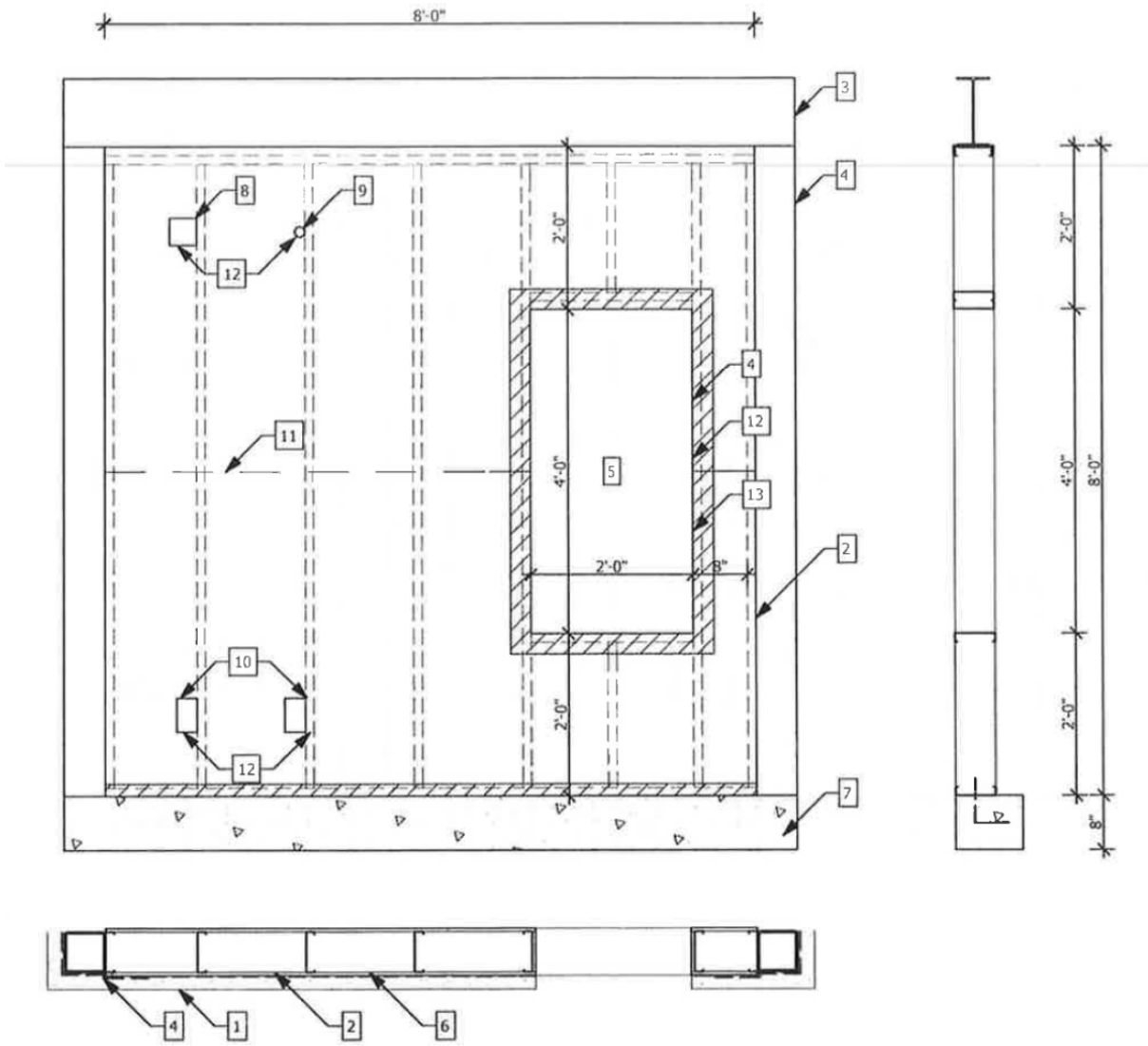


Figure 5. "Icynene ProSeal Air Barrier System" steel stud wall specimen with window, pipe, duct and outlet penetrations continuity details